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The effect of *meta*-topolin (*mT*) and *meta*-topolin riboside (*mTR*) on the micropropagation of 'Williams' Cavendish banana was studied in comparison with benzyladenine (BA). *In vitro* cultures of Williams' banana, at third sub-culture level, were purchased from African Biotechnologies (Pty) Ltd South Africa. These were then sub-cultured on Murashige and Skoog media containing 15, 22.2 and 30 μ M of BA, *mT* and *mTR* and supplemented with 2 mg/l indole-3-acetic acid (IAA), 3% sucrose, 0.2 g/l adenine sulphate, 0.38 g/l sodium dihydrogen orthophosphate and solidified with 2 g/l gelrite. Results recorded after six weeks of growth demonstrated that there were statistically significant differences in the number of shoots and roots between the treatments at 22.2 μ M concentration. This concentration was previously reported to be optimum for banana micropropagation. At 15 μ M there was excessive vegetative growth of individual plants with little or no multiplication. The 30 μ M concentration on the other hand resulted in the growth of a mass of undifferentiated tissue. At 22.2 μ M, *mTR* gave the highest multiplication rate (5.3 shoots per explant). BA-treated plants rooted better in the multiplication medium (contrary to our previous finding on *Aloe polyphylla*) and *mTR*-treated plants produced the least number of roots. *mT* treatment gave intermediate results in both shoot and root numbers. There was no significant difference in shoot length between the treatment means compared to the control. The effect of *mT* and *mTR* on somaclonal variation is being further investigated.

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Deep structure analysis: Finding scale-breaks in vegetation along the Shingwedzi River

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Many South African ecologists are trying to adopt an ecosystem approach to management and create policies that adhere to a complex systems paradigm. Within this paradigm, we view ecosystems as a nested hierarchy of scale domains, created through the emergent properties of interacting components at lower levels. Understanding the multi-scale structure inherent in complex systems and incorporating it into project design and monitoring schemes is problematic. To date a methodology to analyze scales of pattern expression in spatial data objectively is unheard of. We discuss the concept of Deep Structure in the landscape and present a linear scale space methodology aimed at understanding the scaled nature of tree distribution patterns as a response to ecological drivers. We present an early test of this methodology which will change the way we view scale issues in landscape ecology, allowing insight in to the ways in which ecosystem drivers affect the inner workings of a complex system.

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A molecular phylogeny reveals evidence of rapid and recent radiation in Cape and Australian members of the genus *Zygophyllum*

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The chloroplast *trnL* intron, *trnLF* spacer and *rbcL* sequences of a representative subset of *Zygophyllum* species occurring in the paleotropical arid areas of South-eastern and central Asia, North Africa, South-western Africa and Australia were determined and a phylogeny constructed with Bayesian statistics.

The phylogeny was subsequently dated using penalized likelihood. The tree topology and branch lengths of the tree with the highest likelihood score from the Bayesian analysis was used for ancestral state area reconstruction using likelihood optimization in Mesquite version 1.2. Eight clades which are largely restricted to specific areas, and to which the basal node in that clade optimizes to a specific ancestral area, were identified. The number of species that radiated in a given area was counted, minus the species that had migrated out of the specified area. Radiation rates were calculated by relating species number in a given area to the age of the radiation. This revealed that the highest radiation rate in all of these areas was in the Cape and Australia. These findings and their implications will be presented.

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Perspectives on seed recalcitrance

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Stated most simply, recalcitrant seeds are sensitive to desiccation and are non-storable for one or more reason. The trait does not appear to have a taxonomic basis, and is predominant in tropical mesic habitats; however, seed recalcitrance does occur in a few temperate species, and in both habitat-types, provenance may have a marked effect on the degree of recalcitrance exhibited by a species. Among the underlying causes of recalcitrant behaviour in all cases, is that the seeds lack, or do not express, the various mechanisms entrained by desiccation-tolerant, orthodox seeds (and tolerant vegetative material); one of these is that there is no 'shut down' of metabolism as occurs in orthodox types, thus seed development grades into germination without any punctuating event. Current understanding of the major mechanisms conferring desiccation tolerance in seeds will be discussed, so that the implications of their absence/non-functionality in recalcitrant seeds can be appreciated. The presentation will also highlight complexities that complicate research on seed recalcitrance, as well as attempts to conserve the genetic resources of species producing such seeds. In the latter case, requirements to optimise short- to medium-term seed storage, cryostorage of excised embryonic axes, and the development of alternative explants for cryopreservation, are all aspects that will be enlarged upon.

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Red-listed: To be or not to be? A case study of *Stenostelma umbelluliferum*

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Schizoglossum umbelluliferum was described in 1895. The type specimen is thought to have been destroyed in World War II, resulting in the species remaining obscure. In 1999 it was taken into the synonymy of *Xysmalobium involucreatum*, a species that is common and widely distributed. After its rediscovery in 2003, there was concern that the species was extremely rare and possibly threatened; it was also apparent that it belonged to the genus *Stenostelma*. The species was temporarily listed as Data Deficient, owing to lack of information on distribution and population status, as well as taxonomic uncertainty. As a precautionary measure, it was immediately added to Gauteng's Red List. Because of threat of development of the location of the only known populations in mid-2004, it was categorised as Critically Endangered. A survey was subsequently undertaken to establish a more precise distribution range of the taxon, resulting in more locations being recorded. This led to the downlisting of the Red List status of this species. Its conservation status has thus undergone a number of changes since its re-discovery: from Data Deficient to Critically Endangered, and then to Vulnerable and eventually to Near Threatened. The re-discovery of this plant and the various assessments of its conservation status

have led to much controversy among both developers and landowners in the area. Many species in South Africa, especially those that are listed as Data Deficient or have a taxonomic problem, have to be addressed urgently to gain more accurate and reflective Red Lists.

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Effect of provenance on chilling sensitivity of recalcitrant seeds, putatively of a single species

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Recalcitrant seeds are desiccation sensitive and may be chilling sensitive. However, our studies have indicated that seeds of *Ekebergia capensis* from northerly provenances may be markedly chilling sensitive, while those from further south are less so. In this study, the effects of chilling on viability, selected biochemical aspects and ultrastructure of seeds of *E. capensis* were investigated after storage under hydrated conditions at chilling (1, 3, 6 °C) and non-chilling temperatures (16 °C). The chilling sensitivity of seeds from Tanzania > northern KZN > eastern Cape. Whereas those from eastern Cape retained 80% viability after 12 weeks at 1 °C, at the other extreme, viability of all the seeds from Tanzania was lost after 6 days at 3 °C. Although the species is classified as *Ekebergia capensis* irrespective of provenance, analysis of the nuclear ribosomal ITS1 region of the DNA revealed distinct separation among the populations.

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Colonizing a desert wetland: Population history of the Nile crocodile in south-central Africa represents a biotic signature from an ancient palaeo-lake

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The Nile crocodile, *Crocodylus niloticus*, is a dominant predator of rivers and wetlands in sub-Saharan Africa. In this study, we integrate analyses of microsatellite loci and mitochondrial DNA sequences to investigate the phylogeographic history of the Nile crocodile in the Okavango Delta and neighbouring Upper Zambezi and Chobe Rivers. This study asks whether populations presently confined to these wetlands reflect influences of landscape evolution across this dynamic drainage basin. Although the Okavango Delta is maintained primarily by seasonal inflow from the Angolan highlands, it retains ephemeral links with neighbouring drainage systems originally shared during the Plio-Pleistocene. Thus, we were especially interested to test for evidence of historic gene flow across these wetlands. Microsatellite data suggests the presence of significantly differentiated lineages within the separate drainage systems while analysis of control region sequences indicates a sustained period of population growth across the region that peaked around one million years bp. This discovery suggests that extant populations of crocodiles in the Delta and neighbouring rivers represent the vestiges of a much larger population, which originally exploited the ancient Palaeo-Lake Makgadikgadi (PLM). Archaeological and geological evidence constrains the tenure of PLM to the late Pliocene and early Pleistocene, and reveals its desiccation initiated at least 500 Kya. We propose a model where extant lineages are remnants of dispersal events that occurred during periods of increased flooding. This process likely consisted of a series of demographic changes that occurred over hundreds of

thousands of years as wetlands became intermittently linked, allowing crocodiles to move between what are today isolated systems.

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Size class structure of three commonly traded bulbs at Faraday (Johannesburg) *umuthi* market: Implications for sustainability

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Resource harvesting can drive plant populations to extinction if harvesting increases to chase dwindling yields. The effect of trade on medicinal bulb species is poorly known, however by examining medicinal markets as centres of trade, the effects of trade on plant populations can be determined. Size class distributions allow identification of poorly represented life history stages and may also indicate declining recruitment. Ten samples of *Boophone disticha*, *Bowiea volubilis* and *Drimys altissima* were purchased from Faraday *umuthi* (Johannesburg) market in 2007. The relationships between (a) mass and diameter and (b) mass/sale and cost price (Rand/kg) were determined. The size class distributions of all three species were also determined. The size class distribution for *B. volubilis* did not follow a normal distribution ($K-S d=0.22240$; $P<0.01$) and was skewed by numerous small and a few medium sized bulbs. Hence the trade is negatively affecting the population of this species. In comparison to the other species, the number of bulbs per sale is high for *B. volubilis*, while the mass per sale is low. For all three species there was a positive and disproportionate relationship between diameter and mass and an inverse and disproportionate relationship between mass/sale and Rand/kg. Trade in medicinally used bulbs can have a negative impact on commonly traded species. These impacts are influenced by species specific growth rates, survival rates and responses to harvesting. Continued monitoring of commonly used species is needed to prevent further negative impacts.

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Systematic studies in the genus *Lebeckia* and related genera (Crotalariaeae, Fabaceae): A new generic classification for *Lebeckia*

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The genus *Lebeckia* is a group of papilionoid legumes that occur throughout the Cape and extend northwards into the south-western parts of Namibia. It comprises ca. 36 species which are currently accommodated in four sections, viz. *Calobota*, *Lebeckia*, *Stiza* and *Viborgioides*, and one as yet unplaced species, *L. inflata*. Analyses of the internal transcribed spacer (ITS) of nuclear ribosomal DNA and plastid *rbcL* sequences of 175 samples representing all major lineages of the tribe Crotalariaeae indicate that *Lebeckia* is paraphyletic. These analyses, along with morphological and anatomical data, suggest that the genus should be divided into three genera, viz. *Lebeckia* s.s. (*L. sect. Lebeckia*), *Calobota* (*L. sect. Calobota* and *L. sect. Stiza*) including the monotypic genus *Spartidium* and *Acanthobotrya* (*L. sect. Viborgioides*, *L. inflata* and *L. mucronata*). Informative characters supporting these groups were found to be a combination of habit, bark formation on twigs, leaf type and anatomy, and anther configuration. These characters, along with the results from the DNA sequence data, will be discussed.

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